Microeconomics II

March 11, 2026
Duration: 50m+40m

Midterm 1

Full name: .....

Student number: ..... Class: .....

1. This exam consists of two parts. Part A consists of 12 multiple-choice questions and is worth 10 points. Part B consists of 2 open questions and is also worth 10 points.
2. Part A must be completed in 50 minutes and Part B in the remaining 40 minutes.
3. Indicate your answers to part A with an "X" in the table below. Each correct answer is worth 10/12 ($\approx$ 0.83) points and each wrong answer is penalized by (10/12) /3 ($\approx$ 0.28) points.
4. Any kind of consultation is not allowed.
5. Turn off mobile phones, computers, tablets, and smartwatches. Their use will be considered fraud. The use of a non-graphical calculator is allowed.
6. Write your full name and student number on every answer sheet.
7. Return this answer sheet even if you withdraw from the exam.

ANSWER TABLE

1	2	3	4	5	6	7	8	9	10	11	12
a	a	a	a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d	d	d	d

English – Version A

PART A
MULTIPLE CHOICE (10 points / 50 min)

1) In an expected utility framework, suppose an individual's utility over wealth is given by $u(w) = \ln(w)$. The individual is offered a gamble that pays €120 with probability 40% and €60 with probability 60%. Which of the following statements about the certainty equivalent of this gamble is correct?

a. It is lower than the expected value of the gamble.
b. It is independent of the probabilities.
c. It is equal to the expected value of the gamble.
d. It is lower than the expected value only if the probability of the lower payoff is sufficiently high.

2) Consider a risk-averse individual facing income uncertainty. Suppose the individual can buy insurance to reduce income risk. Which of the following best describes the optimal insurance choice?

a. A risk-averse individual will always choose full insurance regardless of the insurance premium.
b. The optimal insurance contract trades off insurance costs and risk reduction, and full insurance is not necessarily optimal when insurance is actuarially unfair.
c. Risk-averse individuals prefer uncertainty if the expected income is higher.
d. Insurance demand is independent of risk preferences.

3) In the presence of a negative production externality, the optimal Pigouvian tax is equal to:

a. The marginal external cost evaluated at the social optimal quantity.
b. The social marginal cost evaluated at the private optimal quantity.
c. The private marginal cost evaluated at the social optimal quantity.
d. The average external cost across all units produced.

4) According to the Coase Theorem, if property rights are assigned to the polluter and transaction costs are zero, which outcome should be expected?

a. The polluter will continue polluting at the original level.
b. The affected party will compensate the polluter to reduce pollution to the efficient level.
c. The government must intervene by imposing a pollution tax.
d. The polluter will cease production entirely to eliminate pollution

5) Consider a health insurance model with two types of consumers (high-risk and low-risk). Which of the following characterizes a separating equilibrium?

a. Both types purchase the same insurance contract.
b. High-risk consumers purchase more insurance, while low-risk consumers purchase less insurance.
c. Low-risk consumers purchase more insurance because they face lower premiums.
d. No consumers choose to purchase insurance.

6) In signalling models with asymmetric information, education may serve as a signal of ability in the labour market because:

a. Education increases average productivity.
b. The cost of acquiring education is lower for high-ability workers.
c. Employers cannot observe education levels.
d. The government subsidizes education for low-ability workers.

7) Which of the following best distinguishes adverse selection from moral hazard in insurance markets?

a. Adverse selection arises before the insurance contract is signed, while moral hazard arises after insurance is purchased.
b. Adverse selection occurs only in health insurance markets, whereas moral hazard occurs only in automobile insurance markets.
c. Adverse selection increases the number of insured individuals, while moral hazard decreases it.
d. Adverse selection arises when consumers cannot observe coverage levels, while moral hazard arises when insurers cannot observe insurance prices.

8) Consider a monopolist who can practice first-degree (perfect) price discrimination. Which of the following is true?

a. The monopolist charges a uniform price equal to marginal cost.
b. The monopolist's profit is zero because of intense competition among consumers.
c. The monopolist sets quantity where marginal revenue equals marginal cost.
d. The monopolist captures the entire consumer surplus and produces the efficient quantity.

9) In a natural monopoly, average costs are decreasing over the relevant range of output. A regulator aiming for allocative efficiency may implement a two-part tariff to ensure the firm breaks even. How should this tariff be structured?

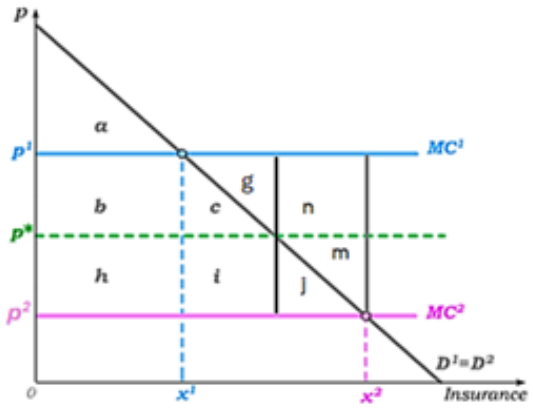
a. Set the per-unit price above marginal cost and the fixed fee equal to zero.
b. Set the per-unit price equal to marginal cost and choose the fixed fee to cover the firm's losses.
c. Set the price equal to average cost, which ensures efficiency by guaranteeing zero profit.
d. Set the per-unit price below marginal cost and use the fixed fee to subsidize consumers.

10) Consider a cap-and-trade system in which the regulator significantly reduces the emissions cap to meet stricter climate targets. Assume firms' short-run demand for permits remains unchanged. Which outcome is most likely?

a. The permit price increases, incentivizing greater emissions reductions by firms with lower marginal emission reduction costs.
b. The permit price decreases because fewer permits are available for trading.
c. Total emissions increase as firms purchase more permits to offset scarcity.
d. The new cap has no effect on permit prices, since prices depend only on firms' private costs.

11) In the market depicted in the graph below, insurers face two types of drivers: high-risk drivers (MC^1) and low-risk drivers (MC^2). Under asymmetric information, insurers charge a pooling price p^*. Under full information, each type pays its actuarially fair premium (p^1 and p^2, respectively). Focusing only on low-risk consumers, what happens to insurers' profits *from this group* when the market moves from the pooling price $p^*$to the separating price p^2?

a. Profits increase because at the lower price (p^2), low-risk consumers purchase more insurance.
b. Profits decrease because at price (p^2), insurance is sold below cost.
c. Profits decrease because at price p^2, insurers no longer earn positive profits from low-risk consumers.
d. Profits increase because high-risk consumers cross-subsidize low-risk consumers.



12) The Marquês de Pombal roundabout in Lisbon is a central node in the city's road network. Access is unrestricted and free of charge. Persistent traffic congestion is observed. Users of this roundabout tend to ignore the _____. As a result, this situation may lead to the _____.

a. Positive consumption externality; exclusivity.
b. Negative production externality; tragedy of the commons.
c. Positive production externality; escalation of vehicle production.
d. Negative consumption externality; tragedy of the commons.

PART B
OPEN QUESTIONS (10 points / 40 min)

Question 1

The United States (US) is considering an aggressive diplomatic proposal to acquire Greenland, which is currently part of the Kingdom of Denmark. This decision involves substantial uncertainty.

The US must choose between:

- proceed: Proceed with the aggressive proposal
- not proceed: Maintain the status quo

If the US proceeds, their future wealth W depends on the outcome of the aggressive proposal:

- The proposal is successful (probability $p = 0.7$): $W = 2500$
- The proposal fails (probability $(1 - p) = 0.3$): $W = 1444$

If the US does not proceed, the status quo is preserved and US wealth remains at $W = 1764$. The utility function of the US is given by: $U(W) = \sqrt{W}$.

If the US proceeds, Denmark's future wealth W also depends on the outcome:

- The proposal is successful (probability $p = 0.7$): $W = 200$
- The proposal fails (probability $(1 - p) = 0.3$): $W = 700$

If the US does not proceed, the status quo is preserved and the wealth of Denmark remains at $W = 900$. The utility function of Denmark is linear: $U(W) = W$.

a) Show whether the US will proceed with the aggressive proposal. Use calculations to justify your answer. (1 pt)

b) Denmark wishes to prevent the crisis and proposes a pre-emptive agreement. In particular, Denmark considers offering an economic package to the US of total monetary value T, in exchange for a binding agreement in which the US commits not to pursue the aggressive proposal. Determine the minimum value of T that makes the US indifferent between "proceed" and "not proceed". (1 pt)

c) How much is Denmark willing to pay to make the US choose "not proceed" (i.e., to prevent the aggressive proposal)? Use your answers to questions b and c to evaluate whether there is room for a mutually beneficial agreement. (2 pts)

d) Provide an intuitive discussion (without calculations) of whether reaching an agreement would be easier or more difficult if both countries were risk seeking. (1 pt)

Question 2

The Kangerluk region, located on the western coast of Greenland, contains one of the world's largest deposits of rare minerals used in batteries and advanced technologies. The company ArcticRare Minerals has obtained permission to operate an open-pit mine and export minerals to Europe.

Extraction involves crushing rock and using chemical agents that release airborne particles and generate water pollution. Residents of Kangerluk report increases in respiratory health problems, deterioration of water quality, and negative impacts on coastal fisheries.

Environmental studies estimate that each unit of mineral extraction q generates a constant external marginal cost:

$$EMC = 12$$

The firm's private marginal cost is given by:

$$PMC(q) = 6 + 2q$$

European demand for rare minerals is represented by:

$$PMB(q) = 90 - q$$

a) Calculate the deadweight loss associated with the negative externality under an unregulated competitive market outcome. Hint: use a graph to guide your analysis. (2 pts)

b) Calculate the optimal Pigouvian tax per unit that should be imposed on ArcticRare Minerals to correct the externality. (1 pt)

c) Discuss who gains and who loses from the introduction of the Pigouvian tax. Your answer should consider consumer surplus, producer surplus, externality costs, the welfare of Kangerluk residents, and tax revenue. (1 pt)

d) Instead of a Pigouvian tax, the government introduces a tradable permit market where each permit allows the extraction of 1 unit of mineral. Extraction without a permit is prohibited. State the total number of permits that should be issued to guarantee the socially efficient level of extraction. Also explain why permit trading between firms can ensure efficiency when multiple producers exist. (1pt)

Question 1

a)

If proceed: expected utility of US is $EU = 0.7\sqrt{2500} + 0.3\sqrt{1444} = 46.4$

If not proceed: utility of US is $U(W) = \sqrt{1764} = 42$

So, the US proceeds.

b)

The US is indifferent if $U(X) = EU$. Hence, if $\sqrt{X} = 46.4$. This implies $X = 46.4^2 = 2153$. This implies the minimum $T_{USmin} = 2153 - 1764 = 389$

c)

If proceed: expected utility of Denmark is $EU = 0.7 * 200 + 0.3 * 700 = 350$

If not proceed: utility of Denmark is $U(W) = 900$

This implies the maximum Denmark is willing to pay is $T_{Dmax} = 900 - 350 = 550$. Since $T_{Dmax} > T_{USmin}$, they can come to a mutually beneficial agreement consisting of $T_{USmin} \leq T \leq T_{Dmax}$.

d)

It would be more difficult. If both countries were risk seeking, they generally prefer risky outcomes over certain ones. Hence, one should pay more to incentivize the US to "not proceed" but in fact Denmark would be less willing to do so.

Question 2

a)

The DWL is the triangle that is formed by (i) the difference between the market and socially optimal outcome and (ii) the difference between the private and social marginal cost (hence the external marginal cost)

The unregulated market outcome q^m: $PMC = PMB \rightarrow 6 + 2q = 90 - q \rightarrow q^m = 28$

The social optimal outcome q^*: $SMC = PMB \rightarrow 6 + 2q + 12 = 90 - q \rightarrow q^* = 24$

Hence, DWL $= (28 - 24) * 12 * 0.5 = 24$

b)

Optimal Pigouvian tax is the EMC in the social optimum. Hence, $\tau^* = EMC(q^*) = 12$.

c)

- Consumer surplus goes down: consumer price goes up and quantity goes down
- Produce surplus goes down: producer price goes down and quantity goes down
- Externality costs go down: quantity goes down, so less externality costs
- Welfare of residents goes up: quantity goes down, so less externality costs, that would otherwise be inflicted on the residents
- Tax revenue goes up: the difference between the consumer and producer price is the Pigouvian tax (τ^* is 12 per q) and the total tax revenue is $\tau^* * q^*$

d)

(i) Since $q^* = 24$, the optimal total number of permits is 24

(ii) Companies with low marginal costs reduce their pollution further and sell licenses to companies with higher marginal costs